section through the left hemisphere, passing one-half centimetre anterior to the island of Reil, and revealing an apoplectic cyst of a rectangular form, as seen in the figure.

Figs. 4 and 5. Representation of two minute degenerated blood-vessels. In the one (Fig. 4), the formation of a minute aneurism will be observed.

Fig. 6. Component elements of the pseudo-membrane lining the cyst in the island of Reil—*a* and *b*—probable remains of colored blood corpuscles of the clot; *c*, the same elements covered with minute hæmatin crystals, and in company of a large hæmatin crystal.

Figs. 1, 2, and 3, are represented reduced to three-fourths of the natural size. Figs. 4, 5, and 6, are magnified 420 diameters.

ART. II.—TUMOR IN THE CEREBELLUM.

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MR. J. F. M——, æt. 30 years, was seen by request of Dr. W. H. H. Hastings, on August 23. On his father's side consumption was very prevalent. He has never had rheumatism nor venereal disease. Once he had a yellow skin. When five years old he fell over the bannisters and was partially insensible, but soon recovered and never noticed any bad effects from the fall. Last December he first became subject to attacks of dizziness and pain in the head. Before that he had worked hard and late. At times the attacks were severe. Last May he had a sickness which was called a slight attack of diphtheria; after it there was no paralysis, but the dizziness was worse, and the headache was more constant and more severe; it was increased by change of position, especially by lying down after having sat up. There was considerable pain in the eyes; no double vision. Pupils and eyes acted naturally. There was no facial paralysis, no mental disturbance; notwithstanding the very severe pain, the mind was clear almost to the very last. Tongue was protruded straight; there was no tremor of the facial muscles, no exaggerated reflex action.

Apparently there was a slight diminution of sensation in the legs, a very slight inco-ordination of the hands, with tremulousness on motion. When he tried to walk there was considerable festination; he went across the room half running, head leaning well forward, as if about to fall on his hands; turned towards the left in the arc of a rather large circle, and brought up against a table. He returned to the bedside in the same manner, bearing rather to the right. There was no irregular jerking of the legs. When supported, he walked better, without festination, but with evident effort, as if the legs were weak or tired. He could not stand with his feet near together, even with his eyes open. The ophthalmoscope showed the vessels clouded and the outline of the disks indistinct. There had been vomiting, and this occurred subsequently several times.

Dr. Hastings found the urine acid, 1030; normal, excepting that urates were abundant; and I learn from Dr. Hastings' notes, which he kindly allowed me to use, that he continued to suffer from severe headache, occurring in paroxysms, sometimes excruciating. About a week after he was first seen, he was very comfortable, the attacks of pain were shorter and less frequent, the pulse was 64, but in three or four days the headache was very severe again, pulse rose to 104. On the ninth of September, after an attack of pain, he could not talk as usual, or could not say what he wished to: for instance, when he wished to have the clothes taken off, he said, "take off the bed." He could not make himself understood by writing.

September 18 he died; previously he had several attacks of general spasms, stiffening out his whole body and limbs. On the morning of the 18th he had two attacks of unconsciousness. His mental powers were good up to the day before his death.

Autopsy about twelve hours after death.

The membranes were healthy; the vessels at the base were unchanged. The convolutions were flattened. The substance of the brain was firm and dry; the pia mater was dry. The ventricles contained an unusual amount of serum, which was not measured. Over the upper surface of the cerebellum on the median line, over a space of about an inch in diameter, the pia mater was considerably thickened and adhered to a tumor, which was about one inch in diameter, and entirely imbedded

in the cerebellum. The tumor retained very nearly the shape of the cerebellum, and was very nearly on the median line, only a very little more to the right than the left. The tumor was very soft, semi-translucent, its boundaries tolerably well defined No other changes were found.

Microscopically the tumor showed merely nuclei, or small cells, with nuclei about as large as the cell, and a small amount of fibrous tissue mingled with the cells. No changes have been found in the medulla, nor in the upper part of the cord; the restiform bodies, which are continuations of the inferior cerebellar peduncle, were unchanged. No examination has yet been made of the optic tracts.

The diagnosis made when the patient was first seen, was—tumor, probably in the posterior part of the brain or cerebellum. Before the autopsy, the locality was more defined—in the upper part of the cerebellum, or attached to the tentorium, pressing upon the cerebellum. I did not attempt to say on which side the new growth was.

The grounds upon which this diagnosis was made were: the severe and persistent headache, rendered worse by lying down; dizziness and vomiting. The inco-ordination in both arms and legs; the peculiar mode of walking with festination. Especially the retinal changes.

Such severe and persistent headache, from December to August, in a man of his age, is enough of itself alone to arouse solicitude; to cause a suspicion of cerebral lesion. This suspicion was made stronger by the presence of dizziness and vomiting. Inco-ordination is found in spinal diseases, but when associated with the headache, dizziness and vomiting, with such manifest festination, it pointed rather to cerebral lesion. The ophthalmoscope decided the diagnosis. Without this I could not have been so positive of the correctness of the diagnosis.

The diagnosis of the nature of the cerebral lesion was also guided by the retinal changes. Sclerosis is not accompanied with retinitis, but rather with atrophy; also there was no tremor and no mental disturbance. The symptoms were too slowly developed, and not sufficiently acute, to be caused by meningitis. There were not the symptoms of cerebral pres-

sure which would be found in hydrocephalus. A tumor was consistent with the symptoms.

The locality of the tumor was determined almost entirely by elimination. In the anterior lobes, mental disturbance, emotional disturbance, motor paralysis, or spasmodic action, would be likely to have been present. Had the tumor been at the base of the skull, some one or more of the cranial nerves would have been implicated. It must then be, that either the posterior lobe or the cerebellum was the seat of the tumor. The presence of inco-ordination and the peculiar gait decided for a locality which would implicate the cerebellum. Had the tumor been on the under surface of the cerebellum, some of the nerves arising from the medulla and pons or those organs must have been affected, and probably to a considerable degree. A morbid growth in the substance of the cerebellum, or pressing upon its upper surface, would also be likely to exert sufficient pressure upon the medulla to give rise to the slight symptoms referable to that region—slight impairment of sensation in the legs, and perhaps in a measure the weakness of the legs. Partly, therefore, by exclusion, and in part from the symptoms present, the diagnosis was made.

Many, perhaps most of the symptoms recorded in cases of tumor of the cerebellum, depend upon the secondary affection of other parts of the encephalic nervous centres. The extension of the disease to neighboring parts, the presence of multiple lesions, and, most of all, pressure, will explain the diversity of symptoms.

Headache is the most constant symptom, and it is very commonly occipital. Thus, in 201 cases, headache is expressly mentioned as occurring in 165. In 169 cases, where particulars are given, it was said to be occipital in 57 cases, frontal in 10, and was general, or the locality was not mentioned, in 60. Lussana (*Journal de Physiologie*, t. vi., 1863) says that in 128 cases, headache was rarely wanting. The character of the pain is one of great severity; language often being exhausted to express the patient's suffering. So severe is the pain, and so much is it increased by motion, that the patient will seem to be in a semi-coma, and will avoid speaking even, lest the pain should be increased. It may well be that such a patient might

be thought to have lost mental power. This pain is probably caused by pressure upon inflamed membranes; the cerebellum being closely confined beneath the tentorium, a very slight increase in size would exert a pressure which would give rise to severe pain.

An unusual quantity of serum was found in the ventricles in 30 cases, that is, a little more than 17 per cent. In 17 cases the middle lobe alone was affected; of these, 4 were accompanied with serum in the ventricles; that is, a little more than 23 per cent. One or other of the lateral lobes was affected in 104 cases without the middle lobe being mentioned. In 17 excess of serum occurred; that is, in somewhat over 16 per cent. Serum was found in rather over 28 per cent. of the cases where no mention is made of the particular locality of the lesion.

When it is taken into account that many autopsies are not very carefully reported, and that lesion of one lateral lobe may encroach upon the middle lobe, or may be situated near the median line, it is interesting to notice how large a proportion of cases with dilated ventricles had the middle lobe diseased. Pressure upon the vena Galeni, the straight sinus, or the torcular Herophili, will explain the presence of the serum; that is, pressure at the median line; but pressure on one lateral sinus might, and very likely would, be insufficient to cause the dropsy. The vena Galeni, it will be remembered, receive the blood from the corpus striatum and the choroid plexus, and empty into the straight sinus. But all these percentages must be taken *cum grano salis.*

Immediately connected with the hydrocephalic phenomena are the affections of the eyes. In 201 cases, ocular disturbance occurred 91 times,—nearly in one-half,—45 per cent. In many cases the sight was entirely lost; in others, only partially. As the eyes are rarely carefully tested, it may well be that many cases of slight defect of vision were unnoticed, and unless the ophthalmoscope was used, it would not be safe to say of any case that the optic nerve and retina were entirely free from disease; for not infrequently changes can be found when vision is unaffected. In the case I have reported, the patient was not aware of any defect of vision, yet changes

were found at the fundus of the eyes which materially assisted in a diagnosis.

As a rule, both eyes are affected, and generally in equal degree. In one case, however, reported by Vulpian (*Compt. Rend. de la Soc. de Biol.*, 1861), the left eye was blind; sight was retained in the right eye. In this case the right lobe of the cerebellum contained a tubercular mass the size of a pullet's egg; this extended a little beyond the median line. The right half of the floor of the fourth ventricle was softened, the median line exactly limiting this change. The left lateral ventricle contained much more serum than the right. The corpora quadrigemina were healthy.

This case confirms a statement made by Allbutt ("On the Use of the Ophthalmoscope in Diseases of the Nervous System and of the Kidneys," 1871, p. 160): "It would seem to me, then, that softening and pressure, rather than inflammation, are the agents of interference with vision. But it is to the interference with the venous circulation that I would attribute the amaurosis in a large number, if not in the majority of cases of cerebellar tumor." It is easily conceivable that pressure directly upon the corpora quadrigemina, by the tumor, may sometimes cause amaurosis. The pressure by ventricular fluid upon the optic tracts would generally affect both sides alike, hence vision is frequently affected in both eyes. Galezowski considers that the amaurosis is caused by the propagation of inflammation from the tumor through the superior cerebellar peduncles to the corpora quadrigemina. In the present case there may have been some retinitis, but it was by no means very marked; serous exudation; pressure, I should think, might have been a sufficient cause for the changes. If Galezowski's view were correct, one would expect much more frequently that the affection of sight would be unilateral. In either view, however, the amaurosis is not due to the lesion of the cerebellum, but is a symptom depending upon secondary changes elsewhere.

The pupils, when affected, are generally dilated; occasionally are contracted. Thus they are mentioned as dilated 37 times, as contracted only 4 times. It is not unlikely that, in many cases, the condition of the pupils is overlooked and no notice

is taken of them. Sometimes the condition of the retina or optic tracts are the cause of the dilatation; again, the state of the pupils may be due to other secondary changes,—it is not directly dependent upon lesion of the cerebellum.

Vomiting is a frequent symptom, occurring 93 times in 201 cases. Lussana, however, found it mentioned only 28 times in 128 cases. Vomiting is found in other lesions of the brain, and in various peripheral lesions. Though the vomiting may be dependent upon the cerebellar lesion, it is not sufficiently characteristic to serve as a very important aid to diagnosis. Macabian agrees with Hillairet that it is due to pressure upon the pneumogastrics. Ladame thinks it not improbable that the vomiting is sympathetic. Should he not say reflex, from the lesion of the cerebellum?

In the case I have reported the mental powers were intact up to the day before death. As a rule, the intelligence is unaffected; when the condition is the reverse, it is because of changes outside of the cerebellum; either other lesions arise, or there is such an hydrocephalic collection of fluid in the ventricles that the pressure causes the coma. Delirium is very rare in uncomplicated cases. It must be considered that there may be secondary meningitis. Sensation is not generally seriously affected.

Disturbance of motor power is one of the most frequent symptoms; in frequency it ranks next to headache, occurring 136 times in 201 cases; and probably this does not express the whole truth, for in many cases the slighter forms of disturbance may have escaped the physician's notice. A patient found in bed with severe headache and restless with pain, which is increased by assuming an erect posture, may move his limbs freely and so be looked upon as free from motor symptoms; but his co-ordinating power has not been tested; or, he may be so weak as not to be able to stand, and no note is made of it.

The motor symptoms may consist either in mere weakness, —marked, but too general to be better defined—33 times; hemiplegia, 15 times; variously described changes which may all be included under the head of inco-ordination, 48 times; contraction and other abnormal changes, 11 times. These

symptoms were many times caused by pressure upon the medulla and pons or crura cerebri, or are to be explained by other lesions; this is especially the case with the cases of hemiplegia. The medulla oblongata lies so immediately beneath the cerebellum upon the bone, that a very slight increase in the size of the latter must necessarily exert a pressure upon the medulla.

Lussana sums up his views: "1. The alteration of the muscular sense is the constant and pathognomonic phenomenon of diseases of the cerebellum and of experimental destruction of that organ.

"2. As to other symptoms, they are inconstant, and vary in the affections of the cerebellum; they are generally wanting in the experiments made upon animals."

Allbutt says: "The cerebellum appears to me to be rather a reservoir of force where, by the means of the posterior columns, tension is stored up during times of repose to be given out during times of demand. Want of capacity of motion rather than palsy, is what we should look for in the loss of such an organ."

Fournié says: "We are disposed to see in the cerebellum an organ for re-enforcing the cerebral actions, designed also to supplement by a special excitation, the action of the will, when the latter is absent, as during sleep, or when it is employed in directing another action."

Some interference with the perfect functioning of the motor powers would then be expected in lesions of the cerebellum. The above analysis of symptoms in cases of tumor agrees with this. Dickinson found in sixteen cases of softening and congestion of the cerebellum where there were no tumors that "the only faculty which constantly suffers in consequence of destruction of the cerebellum is the power of voluntary movement." (*Brit. and For. Med. Chir. Rev.*, Vol. 36, 1865, p. 479.) It would merely be tedious to multiply quotations. In the present case there was weakness and inco-ordination. There was also festination. This has been noticed in only a few cases, two or three; some authorities say that retrograde motions may exist.

Rotatory motions were mentioned in four cases. This

symptom is of no diagnostic importance, as it is found in connection with lesion of many other portions of the encephalon.

Spasms and convulsions occurred in sixty-one cases, but are not of diagnostic value, as they occur in lesions situated in so many other localities.

From this attempt at an analysis of the symptoms of tumors of the cerebellum it appears that motor disturbance is the only phenomenon which can be said to be legitimately dependent upon lesion of the cerebellum itself; other symptoms are caused by pressure upon or secondary changes in other organs. Flint, I think, is rather too cautious in requiring lesion of half the organ to ensure disorder of movement. He says: "Every carefully observed case that we have been able to find in which there was uncomplicated disease or injury of the cerebellum, provided the disease or injury involved more than half the organ, presented great disorder in the general movements, particularly those of progression." ("Nervous System," p. 386.)

But for diagnosis, other than the motor symptoms must be considered. Of course the nature, severity and variety of symptoms will depend upon the size of the tumor, and its position. Severe headache, especially if occipital, should lead to a careful search for other symptoms; then loss of power in upper and lower extremities and especially inco-ordination. Can the patient walk with his eyes shut without marked staggering; can he stand steadily with his eyes shut and his feet close together along their whole inner edges, so as to have a small base of support; can he stand on one foot with his eyes shut; with his eyes shut can he touch with the end of one finger any point of his body, as eye, ear, mouth or nose; can he perform complicated combined movements, as writing, playing piano, etc., with normal facility. It is in doubtful cases that these delicate tests are valuable. If hemiplegia and coarser paralyses are present there is no doubt about the motor disturbance, but such is not diagnostic of the cerebellar lesion, rather arise from pressure upon the medulla or from lesions distinct from the cerebellar lesion; yet it must be borne in mind that the inco-ordination may be unilateral, and be as valuable a diagnostic sign as if bilateral, though such cases I be-

lieve are rare. Implication of the nerves arising from the pons and medulla will aid in locating the disease, but it may cause uncertainty as to whether the cerebellum itself is affected. And if there is also hemiplegia, there may be reasonable grounds for questioning whether that organ is primarily or even chiefly affected, and a history of the progress of the case may not clear up the doubt.

If to the headache and motor disturbance there is added affection of the eyes, and if retinal changes are found, not perhaps well marked retinitis, but swelling of the optic nerve and choked disk, there is additional reason for locating the disease in the cerebellum. Vomiting and dizziness would also aid in forming a diagnosis, and convulsions might be present. There would in uncomplicated cases be little or no affection of sensation, and the intellectual powers would be intact, unless there were symptoms of pressure due to hydrocephalus.

But no one of these symptoms of minor importance are of much assistance in locating the lesion in the cerebellum; it is only as combined together and with others that they are of value. I have seen complete amaurosis with the most extensive neuritis, exudation and hemorrhages, associated with tumor in the anterior lobe, but there was impaired intelligence, and lesion of individual cranial nerves, and no suspicion of cerebellar tumor. I have seen convulsions in lesions of the middle cerebral lobe, and vomiting is not uncommon in any cerebral affection.